

CHAPTERS

CHAPTER 1: INTRODUCTION

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1.1 BACKGROUND

This report concerns amended Statement of Claim (SOC) No. 39-13610 filed by the U.S. Department of Interior, Bureau of Land Management (“BLM” or “U.S.”) for federal reserved water rights within the San Pedro Riparian National Conservation Area (“SPRNCA”). Congress established SPRNCA under the Arizona-Idaho Conservation Act of 1988 (“Act”), which became law on November 18, 1988.¹ In section 102(d) of the Act, Congress reserved water rights for SPRNCA and directed the Secretary of the Interior to file a claim to quantify those rights as part of a stream adjudication. 16 U.S.C. § 460xx-1. A copy of the Act is included in **Appendix A**. In 1989, BLM filed its water rights claim in the general stream adjudication for the Gila River System and Source (“Gila River Adjudication”).²

In 1991, the BLM amended its SOC shortly before the Arizona Department of Water Resources (“Department” or “ADWR”) issued a Final Hydrographic Survey Report for the San Pedro River Watershed (“San Pedro Final HSR”), which included an analysis of BLM’s water rights claims for SPRNCA. On January 31, 2006, pursuant to order dated November 8, 2005 of the Special Master for the Gila River Adjudication (“Special Master”), the BLM amended SOC No. 39-13610 again. Thereafter, by order dated September 26, 2006, the Special Master initiated Contested Case No. W1-11-232 to address objections to the watershed file reports (WFRs) that were associated with SPRNCA. These WFRs had been published in the San Pedro Final HSR and assigned a unique contested case number. The Special Master listed these WFRs in Attachment A to the September 26, 2006 Order, and consolidated them into Contested Case No. W1-11-232.³

Designated Issues for Briefing. By order dated June 28, 2007, the Special Master designated certain issues for briefing, which were then ruled upon by order of the Special Master dated March 4, 2009. Regarding the purposes of SPRNCA, the Special Master ruled as follows:

¹ Pub. L. No. 100-696, 102 Stat. 4571, codified at 16 U.S.C. §§ 460xx-460xx-6.

² *In re General Adjudication of All Rights to Use Water in the Gila River System and Source*, W-1, W-2, W-3, W-4 (Consolidated).

³ By order of the Special Master dated August 16, 2011, the list of WFRs in Attachment A was corrected by changing WFR No. 111-17-063 to WFR No. 112-17-063.

Based on the express language of section 102(d) and the legislative history concerning the issue of reserved water for the SPRNCA, the Special Master finds that the Congress expressly intended to reserve water to accomplish the purposes of the conservation area.

March 4, 2009 Order at 6.

The Act is plain and unambiguous as to the purposes of the SPRNCA. Based on the Act's express language, the Special Master determines that the purposes of the SPRNCA are the protection of the riparian area and the aquatic, wildlife, archeological, paleontological, scientific, cultural, educational, and recreational resources of the conservation area.

Id. at 8. Regarding the priority date for the federal reserved right for SPRNCA, the Special Master ruled as follows:

It is established that a federal reserved water right “vests on the date a reservation is created.” The United States Supreme Court “has long held that when the Federal Government withdraws its land from the public domain and reserves it for a federal purpose, the Government, by implication, reserves appurtenant water then unappropriated to the extent needed to accomplish the purpose of the reservation. In so doing the United States acquires a reserved right in unappropriated water **which vests on the date of the reservation** and is superior to the rights of future appropriators.”

Id. at 14 (emphasis supplied, internal cite omitted).

The Special Master finds that the date of priority of November 18, 1988, does not attach to lands acquired and added to the conservation area after that date. The date of priority of a federal reserved water right for non-federal lands acquired by the United States after November 18, 1988, and added to the SPRNCA is the date of their incorporation within the conservation area.

Id. at 15.

By order dated May 1, 2009, the Special Master identified a second set of issues for briefing and oral argument, which the Special Master ruled on by order dated March 19, 2010. These issues concerned the relationship between BLM's Certificate of Water Right (“CWR”) No. 90103.000, issued by the Department under state law, and BLM's federal reserved water rights claims for SPRNCA. After entering several findings of fact concerning CWR No. 90103.0000, the Special Master ruled as follows:

1. CWR No. 90103.0000 must be considered a water right available to the United States to serve the federal purposes of the SPRNCA, and
2. The beneficial uses of CWR No. 90103.0000 are distinct and separate uses that partially, but not fully, fulfill the federal purposes of the SPRNCA to the extent water is required.

March 19, 2010 Order at 7.

Department's Land Ownership Report. As part of its May 1, 2009 Order, the Special Master directed the Department to file a report by September 11, 2009 concerning certain issues related to the land area comprising SPRNCA. The publication of the Department's report was stayed, at the request of the United States, by order of the Special Master dated September 9, 2009, which was lifted by order dated May 24, 2010. On June 30, 2010, the Department filed its report entitled "Land Ownership Within the San Pedro Riparian National Conservation Area" ("SPRNCA Land Ownership Report"). Appendix F to the report included a table which provided information concerning the ownership and acreage of lands within SPRNCA by parcel number. Pursuant to order of the Special Master dated January 24, 2011, the Department supplemented the SPRNCA Land Ownership Report on April 15, 2011 by providing additional information in Appendix F regarding BLM's acquisition of 26 parcels of land after November 18, 1988 ("Supplemental SPRNCA Land Ownership Report").

1.2 SCOPE OF REPORT

By order dated July 14, 2010, the Special Master directed the Department to file a report on or before April 16, 2012 consistent with A.R.S. § 45-256, described as follows:

The report shall include summarizing the amended claims for reserved and state law water rights, evaluating the methodologies used by the United States to quantify its federal claims, and evaluating the quantities claimed for the state law water rights and claims through field investigations.

July 14, 2010 Order at 5. The Special Master also directed BLM to amend its statement of claimant as follows:

[T]o identify all claimed water rights and their attributes, including reserved and state law rights, for the conservation area. The amendments shall provide information and data that will allow ADWR to prepare a report consistent with A.R.S. § 45-256. The amendments shall take into account the determinations made in the Special Master's orders dated March 4, 2009, and March 19, 2010.

Id. On April 15, 2011, BLM filed its third amendment to SOC No. 39-13610 ("Third Amended SOC"), which some of the parties believed was inconsistent with the Department's Supplemental SPRNCA Land Ownership report concerning dates of incorporation of acquired land. As a result, by order dated August 16, 2011, the Special Master directed the Department as follows:

Directing ADWR to review the land ownership information submitted by the United States in the Third Amended Statement of Claimant and supplement ADWR's land ownership reports if deemed needed and useful.

August 16, 2011 Order at 5.

By order dated April 9, 2012, the Special Master granted the Department's request for an extension of time to May 31, 2012 to file this report. As directed by the Special Master, this report summarizes BLM's Third Amended SOC, evaluates the methodologies used by BLM to quantify its federal reserved water rights claims, summarizes and evaluates the quantities claimed for state-based water rights, and presents the results of the Department's review of the land ownership information submitted in BLM's Third Amended SOC. Copies of the Special Master's orders dated September 26, 2006, March 4, 2009, March 19, 2010, July 14, 2010 and August 16, 2011 are included in **Appendix A**.

CHAPTER 2:
FEDERAL RESERVED
WATER RIGHTS CLAIMS

CHAPTER 2: FEDERAL RESERVED WATER RIGHTS CLAIMS

On April 15, 2011, BLM filed its Third Amended SOC, which cross references five attachments that contain information related to the claim. Copies of the Third Amended SOC and its attachments are provided in **Appendix B**, and are summarized below.

2.1 ATTACHMENTS

The Third Amended SOC incorporates information from five attachments, which are referenced several times throughout the claim. These attachments consist of maps, tables, explanations, and water right abstracts.

2.1.1 Attachment A (SPRNCA Boundary)

Attachment A describes the places of use as the federal lands located within the boundary of SPRNCA. An index map and a series of seven maps together with the legal description of the revised geographic boundary of SPRNCA, as defined in P.L. 100-696 and submitted to Congress in July 2010, were included in Attachment A.

2.1.2 Attachment B (Stream Flows)

Attachment B describes the BLM's claim for stream flows. Attachment B includes a table that lists the claimed monthly "base" for the Babocomari River, based on information from Walnut Gulch; and the San Pedro River, based on information from the United States Geological Survey ("USGS") gages at Palominas, Charleston and Tombstone. The total amount claimed consists of the total annual base flow plus un-impounded storm runoff from seasonal storm events. An explanation of the quantities listed in the table and a map depicting the location of the USGS gages were included in Attachment B.

2.1.3 Attachment C (Groundwater Levels)

Attachment C describes the BLM's claim for groundwater, which consists of minimum groundwater elevations at nine monitoring wells for the maintenance and enhancement of the riparian vegetation community. The locations of these wells are depicted on **Figure 2-1**. Attachment C includes a table that lists the nine monitoring wells, their location, elevation at the top of the casing, depth to water, and water level elevation claimed. An explanation of the groundwater claim and four maps depicting the locations of the monitoring wells for which the water levels are claimed were included in Attachment C.¹

2.1.4 Attachment D (Point Sources)

Attachment D describes BLM claim for discrete or "point" sources within SPRNCA that include springs and seeps, ponds and small lakes, small capacity wells, large production wells formerly used for irrigation and industrial uses, and any other naturally occurring waters such as "seasonal cienegas, small riverside oxbow lakes, undiscovered seeps, springs, ponds, etc." An explanation of the SPRNCA point sources claim and the four maps depicting the locations of the point sources were included in Attachment D. Also included was a table that lists each point source, its location, use and amounts claimed together with abstracts of each of the point sources claimed on a read-only CD-ROM.

2.1.5 Attachment E (Priority Date)

Attachment E describes BLM's claimed priority date and includes a map with a table that lists the dates that non-federal land was acquired for SPRNCA after November 18, 1988. An explanation of BLM's position regarding multiple priority dates for SPRNCA was also included in Attachment E.

2.2 BASIS OF CLAIM

The basis of the Third Amended SOC is listed as a federal reserved water right.

¹ Attachment C was corrected and resubmitted on July 1, 2011.

2.3 PRIORITY DATE

The claim does not list the priority date, but instead cross references Attachment E, which includes the following statements:

Claimed Priority Date:

The date of the reservation is November 18, 1988. All federal lands within the boundary of the SPRNCA at the time of reservation have a priority as of the date of reservation. The dates of later acquisition of non-federal lands within the boundary of the SPRNCA are shown on the attached map, Attachment E.

Explanation:

The United States submits these multiple dates of acquisition in compliance with the Special Master's ORDER DETERMINING INITIAL ISSUES DESIGNATED FOR BRIEFING, dated March 4, 2009. The United States does not concede the legal propriety of multiple priority dates for the SPRNCA and reserves the right to object and challenge any determination or recommendation of a federal water right for the SPRNCA with multiple priority dates. [Emphasis Supplied]

Attachment E is described above in Section 2.1.

2.4 USES

The claimed uses are listed as recreation, fish and wildlife, instream flows, administrative, domestic, fire suppression, maintenance of natural hydrologic processes, and resource conservation, protection and enhancement. The Third Amended SOC also states as an additional comment in paragraph 15 of the claim that, “Present and future uses include water to manage the SPRNCA in a manner that conserves, protects, and enhances the riparian area and the aquatic, wildlife, archeological, paleontological, scientific, cultural, educational, and recreational resources of the conservation area.”

2.5 SOURCES OF WATER

The claimed sources of water are listed as: (1) the San Pedro River and its tributaries within SPRNCA; (2) numerous springs, lakes or reservoirs, with a cross reference to Attachment D, and (3) groundwater, with cross references to Attachment C and Attachment D. These attachments are described above in Section 2.1.

2.6 POINTS OF DIVERSION

The legal descriptions of the points of diversion *per se* are not listed, but there is a cross reference to Attachment D in response to paragraph 7 of the claim that requests information “[i]f there are irrigation, domestic or stockpond uses also supplied from the Point of Diversion.” Attachment D is described above in Section 2.1.

2.7 MEANS OF DIVERSION

The means of diversion are listed as: (1) wells, with a cross reference to Attachment D; (2) instream flows, with a cross reference to Attachment B; (3) springs, seeps and ponds, with a cross reference to Attachment D; and (4) groundwater levels, with a cross reference to Attachment C. These attachments are described above in Section 2.1.

2.8 PLACES OF USE

The places of use are described by cross reference to Attachment A. Attachment A is described above in Section 2.1.

2.9 QUANTITIES OF USE

The quantities of use claimed are listed as: (1) the maximum flow rate for instream flows, with a cross reference to Attachment B; and (2) annual volumes of water use, with cross references to Attachment B and Attachment D.

Attachment B indicates that the following quantities are being claimed for stream flows:

- 15,900 acre-feet per year (“AFY”) at the San Pedro River Palominas gage,
- 28,000 AFY at the San Pedro River Charleston gage,,
- 30,200 AFY at the San Pedro River Tombstone gage, and
- 2,015 AFY at the Babocomari River.

Attachment D indicates that 12,699.647 acre-feet per year are being claimed for 94 point sources. Of that total, Attachment D indicates that, “The combined claim on these large production wells is 11,150 AFA and will be used in emergencies to prevent loss of aquatic and

riparian habitat. Any combination of these wells can be used for this purpose and claim amount.”

The Third Amended SOC does not refer to Attachment C in this part of the claim. Attachment C indicates that the riparian vegetation will consumptively use approximately 12,735 acre-feet per year.

Attachments B, D and C are described above in Section 2.1. The methodologies for the quantities of use claimed are described and evaluated in Chapter 3 of this report.

CHAPTER 3:
QUANTIFICATION
METHODOLOGIES

CHAPTER 3: QUANTIFICATION METHODOLOGIES

3.1 INTRODUCTION

This chapter reviews methodologies used by BLM to quantify its claims to federal reserved water rights for SPRNCA. BLM's Third Amended SOC was summarized in Chapter 2, together with Attachments A through E, which are cross referenced in the claim.

Table 3-1 presents the eight different types of federal reserved water right claims described in BLM's Third Amended SOC. The claims differ by whether the source is surface water or groundwater,¹ and whether the right is exercised at discrete locations or across continuous areas. Claims for water rights with surface water as the source include:

- (1) Streamflows,
- (2) Flows of springs,
- (3) Flows of seeps,
- (4) Water stored in ponds, and
- (5) Water stored in small impoundments (tanks).

Claims for water rights from groundwater as the source include:

- (1) Groundwater use by riparian vegetation,
- (2) Pumpage of small capacity wells, and
- (3) Pumpage of large production wells.

The streamflow and groundwater claims are discussed below.

In support of its Third Amended SOC, BLM also relied upon the following reports, which were submitted to the Department after the Third Amended SOC was filed:²

- (1) *Claims for San Pedro River Streamflow* (BLM, 2006) ("Streamflow Report"),
- (2) *Claims for San Pedro River Ground Water* (BLM, 2006) ("Ground Water Report"),

¹ In this report, the word "groundwater" refers to subsurface water, and not necessarily the legal character of the water. In its claim, the BLM uses the words "ground water."

² At the Department's request, these reports were received by the Department in October 2011.

- (3) *Streamflow and Ground-Water Requirements for Riparian Communities in the San Pedro Riparian National Conservation Area* (BLM, 2006) (“Riparian Report”), and
- (4) *Quantification of Habitat-Flow Requirements for Aquatic Species in the San Pedro River through the San Pedro Riparian National Conservation Area* (Miller Ecological Consultants, 2006) (“Aquatic Habitat Report”).

Copies of these reports are included in **Appendix C**, and are discussed below.

3.2 THIRD AMENDED CLAIMS FOR MINIMUM STREAMFLOW QUANTITIES

The BLM Streamflow Report and Ground Water Report explain that, among other purposes, the Third Amended SOC is intended to restore hydrological conditions representative of those that created the ecological conditions in the SPRNCA at the time of the establishment. For the purpose of quantifying its claim related to hydrological conditions, the Third Amended SOC is organized in two parts: streamflow conditions and groundwater conditions. This section reviews BLM’s quantification of streamflow conditions at the time of establishment, and Section 3.3 reviews quantification of groundwater conditions at the time of establishment.

3.2.1 Commonly Used Terms

Prior to considering the quantification of streamflow conditions at the time of SPRNCA’s establishment, it is important to understand the concepts involved in the following commonly used terms:

- Streamflow is generally considered any water discharge that occurs in a natural channel; derived from all contributing sources including storm runoff and base flow. It normally is expressed as a volumetric flow rate such as cubic feet per second (cfs) or acre-feet per annum (AFA).
- Streamflow hydrographs are used as graphs or tables describing changes in streamflow rates with respect to time.
- Storm runoff (or direct runoff) is generally considered the portion of rainfall that “runs off” and collects from a drainage area once the infiltration capacity of the soil and storage capacity of ground depressions are both exceeded. Runoff begins as shallow overland

flow (sheet-flow) before reaching a natural channel and then considered to be streamflow.

- Base flow is generally considered the portion of streamflow that is not storm runoff and instead derives from either regional groundwater discharge to the stream or drainage of river bank storage following rainfall and floods. Base flow and low flow are sometimes used synonymously. Base flow is difficult to measure directly and is usually estimated using streamflow hydrographs. Two commonly used approaches to estimate base flow are:
 - Defining base flow as some measure of low flows such as the three or seven day monthly low flow value, and
 - Use of a “separation technique” to estimate base flow by graphically removing storm runoff from a streamflow hydrograph.
- Streamflow data are measurements, normally volumetric flow rates, of streamflow at a gaging station. Most streamflow gaging stations, including those within SPRNCA, are operated and maintained by the USGS.
- Daily streamflow data is the basis of statistics routinely performed for characterizing streamflow at a station. It normally includes the minimum, maximum and mean values for each calendar day of the year or each year of record.
- Streamflow statistics are usually based on daily mean data for a station during a selected range of years (period of record).
 - Mean flow is the average value of the daily mean streamflow analyzed annually, monthly or by season during the period of the record.
 - Median flow is the daily mean streamflow met or exceeded fifty percent of the time annually, monthly or by season during the period of the record.
 - ‘X’ percentile exceedance flow is the daily mean streamflow met or exceeded ‘X’ percent of the time annually, monthly or by season during the period of the record.
- Flood return period is the expected average time period between instances of a certain magnitude of streamflow being met or exceeded. The relationship between magnitude and return period is developed for a station by fitting daily maximum streamflow to an assumed statistical distribution and applying a series of corrections. Estimates of

streamflow magnitudes with relatively short return periods such as two or years are more certain than long return periods such as one-hundred years.

- Natural flow regime³ is the term commonly used to describe the dynamic character of natural streamflow. It is the most dominant factor affecting environmental factors such as water temperature, channel geomorphology; and generally the diversity of habitat and abundance of species. The five primary characteristics of streamflow generally considered as defining as the natural flow regime include the following:
 - Magnitude is the amount of water moving past a fixed location at any given time interval.
 - Frequency of Occurrence (recurrence interval) is how often streamflow greater than a certain magnitude recurs.
 - Duration is the period of time associated with a specific streamflow condition.
 - Timing is the predictability or regularity with which a specific streamflow condition occurs.
 - Rate of Change is how quickly streamflow changes from one magnitude to another.

These terms are used throughout this chapter, and an understanding of their definitions is important to the discussion.

3.2.2 Historical Streamflow Records

Review of historical trends in streamflow conditions of the San Pedro River and Babocomari River prior to and after the time of establishment of SPRNCA was included in the Department's evaluation of the Third Amended SOC for streamflow. Historical streamflow data was reviewed from five monitoring locations within SPRNCA that are operated by the USGS and United States Department of Agriculture (USDA) – Agricultural Research Service (ARS). There are four USGS streamflow gaging stations operated within the SPRNCA, including three on the San Pedro River and one on the Babocomari River. Locations of these stations are shown on **Figure 2-1**; and listed from upstream to downstream, the stations are located at Palominas, at Charleston and near Tombstone. The station at Charleston has the longest continuous period of

³ Poff et al., *The Natural Flow Regime – A Paradigm for River Conservation and Restoration*, BioScience Vol. 47, No. 11, 769 – 784 p.

record dating back to 1913, the station at Palominas has a period of record that dates back to 1931, but it has not been continuous, the station near Tombstone has a period of record that dates back to 1967 that has not been continuous, and the station on the Babocomari has only operated since 2000 near its confluence with the San Pedro River.⁴ The ARS also operates a series of streamflow measurement flumes on Walnut Gulch, an ephemeral wash with streamflow comprised solely of storm runoff.⁵

Figures 3-1 through 3-3 show total annual volumes of streamflow measured at the three USGS stations on the San Pedro River at Palominas, Charleston and near Tombstone. Data from each of these stations including investigations involving streamflow conditions between them, have been published in multiple USGS technical reports including the 2006 report referenced later in this section and a 2010 assessment of base flow conditions near Tombstone.⁶ Data from these stations are generally representative of SPRNCA as a whole. The figures are plotted using identical chart axes for time (1935 to 2011) and streamflow (zero to 100,000 cfs) to allow direct comparisons between stations.

Figure 3-4 shows total annual volumes of streamflow measured at the USGS station on the Babocomari River. **Figure 3-5** shows total annual volumes of streamflow due to storm runoff measured at the ARS flume on Walnut Gulch. **Figures 3-4 and 3-5** are each plotted on a time axis of 1935 to 2011 to allow direct comparisons to trends on the San Pedro River.

Within SPRNCA, the largest streamflows occur in response to storm runoff from monsoon storms during the summer months of July, August and September. However, measurements at the Charleston gage show that the trends in seasonal summer streamflow have declined. See **Figure 3-6**. These trends are representative of the general trend for the river.

In 2006, the USGS published a comprehensive statistical analysis of historical streamflow for the San Pedro River for the period from 1913 to 2002.⁷ The USGS analyzed

⁴ Station No. 09471000 at Charleston has a period of record from 1913 to the present. Station No. 09470500 at Palominas has a period of record 1931-1942, 1951-1981, 1996 to present. Station No. 09471550 near Tombstone has a period of record 1967-1986 and 1997 to present. Station No. 09471400 on the Babocomari has a period of record 2000 to present.

⁵ The period of record for the ARS Walnut Gulch flume near its confluence with the San Pedro River is 1956 to present.

⁶ Kennedy, J.R., and Gungle, Bruce, 2010, *Quantity and Sources of Base Flow in the San Pedro River near Tombstone, Arizona*: U.S. Geological Survey Scientific Investigations Report 2010-5200, 43 p.

⁷ Thomas, B.E., Pool, D.R., 2006, *Trends in Streamflow of the San Pedro River, Southeastern Arizona, and Regional Trends in Precipitation and Streamflow in Southeastern Arizona and Southwestern New Mexico*: U.S. Geological Survey Professional Paper 1712, 79 p.

trends in annual, monthly and seasonal statistics of total flows, three-day monthly low flows, and storm runoff. Reported findings of the analysis included the following:

- Streamflow in the summer, spring and fall seasons have all shown significant decreasing trends.
- Total flows have shown significant decreasing trends for the months of June through December.
- Low flows have shown significant decreasing trends for the months of May through December.
- A comparison of streamflow at Charleston from the first twenty years of record (1913–1936) to the twenty years between (1983–2002) demonstrated:
 - Annual total flow decreased by 54 percent,
 - Summer flows decreased by 70 percent, and
 - Winter flows decreased by 20 percent.
- During the 20th century, precipitation and streamflow followed decadal-scale cycles of high and low values. As examples, the 1950s had relatively low precipitation and streamflow while the 1980s were relatively high.
- Factors other than precipitation caused significant trends in total monthly streamflow from 1913 to 2002 including:
 - Changes in upland and riparian vegetation which have decreased total and low flows.
 - Seasonal pumping from wells near the river in the spring and summer has decreased low flows.

Understanding these historical and more recent trends helps to place perspective on the numerical values of volumes of streamflow claimed.

3.2.3 Quantification of the Natural Flow Regime

In order to quantify the natural flow regime, the BLM selected the 35-year period of record from 1954 to 1988 as the representative time frame for hydrologic conditions that created the riparian and aquatic ecosystems present in 1988. This period of record is consistent with the

stabilization of the San Pedro River channel. As described in Hereford (1993)⁸, the San Pedro River underwent a period of entrenchment between 1890 and 1908 and associated period of channel expansion until 1955. The current riparian forest was not present prior to entrenchment and did not develop until after the 1930's. **Figure 3-7** is reproduced from Hereford (1993) with maps showing the pre-entrenchment channel and expansion of the post-entrenchment channel 3.2 km north of the Hereford Bridge. These maps indicate that a period of channel stabilization occurred beginning in 1955. The BLM's period of record begins just one year prior to this time.

Within SPRNCA, the BLM identified the characteristics of the natural flow regime that are important for the support of the ecosystems including: (1) seasonal and monthly variations in base flows (low flows); and (2) high flows of storm runoff from high-intensity, short-duration summer monsoon storms in July, August and September. The monsoons account for a majority of the total annual volume and are unpredictable in their timing and magnitudes. To account for annual variations in streamflow, the Third Amended SOC establishes a range of annual volumes for the San Pedro River and the Babocomari River that consist of two parts: (1) minimum monthly base or low flows, and (2) maximum annual monsoon storm runoff during the months of July, August and September.⁹ The first part is defined by a twelve month hydrograph of median monthly base flow. The second part is the amount remaining after the minimum monthly base flows are subtracted from the median of the annual volumes at the gage during the period of record. The median of the annual volumes is higher than the summation of the monthly volumes based the median of daily means primarily because these monthly volumes do not include peak flows associated with storm runoff events. The water right claim allows the actual amount of streamflow to vary each year depending on activity of the monsoon season, thereby mimicking the natural flow regime.

Just as streamflow at a single location varies from year to year; streamflow varies from location to location in a single year. To account for the spatial variation, BLM used multiple gage sites for its streamflow claims. Quantified streamflow claim volumes apply only at the gage site where the data was taken, and are not additive.

⁸ Hereford, Richard. *Entrenchment and Widening of the Upper San Pedro River, Arizona*, Special Paper 282, The Geological Society of America, 1993.

⁹ The claimed flows in excess of median monthly flows for July, August and September are referred to by BLM in the Streamflow Report (p. 9) as "unimpounded and unconstrained random flood events."

San Pedro River. BLM's streamflow claims for the San Pedro River are quantified for the Palominas, Charleston and Tombstone USGS gaging stations using streamflow data collected between 1954 and 1988. Streamflow claims along the San Pedro River include the following:

- (1) At Palominas: An annual volume up to 15,900 AFA, including a minimum of 2,900 acre-feet (ac-ft.) in median monthly base flows. An additional amount up to the remaining 13,000 ac-ft. of water is to be available in July, August and September from natural "unimpounded and unconstrained random flood events."
- (2) At Charleston: An annual volume up to 28,000 ac-ft. per year, including a minimum of 11,150 ac-ft. in median monthly base flows. An additional amount up to the remaining 16,850 ac-ft. of water is to be available in July, August, and September from natural "unimpounded and unconstrained random flood events."
- (3) Near Tombstone: An annual volume up to 30,200 ac-ft. per year, including a minimum of 9,400 ac-ft. in median monthly base flows. An additional amount up to the remaining 20,800 ac-ft. of water is to be available in July, August and September from natural "unimpounded and unconstrained random flood events."

The Department analyzed the data from the Palominas, Charleston and Tombstone gages and agrees with BLM's calculations. Because the Charleston gage had the longest continuous period of record, the BLM selected that gage as the "index" gage that most reliably described the natural flow regime existing at the time that SPRNCA was established. Because the periods of record for the Palominas and Tombstone gages were not the same as the period of record for the Charleston gage, BLM compared the median annual volume calculated for the Charleston gage using the shorter periods of records for the other gages, which showed less than a 4 percent difference. Based on this comparison, BLM concluded that using the shortened records at the Palominas and Tombstone gages were adequate representations of the entire Charleston period of record. See Streamflow Report (p. 9).

Babocomari River. BLM estimated the streamflow claim for the Babocomari River using data measured from Walnut Gulch, an ephemeral tributary of the San Pedro, because streamflow records for the Babocomari River prior to 1988 were not available. The claimed maximum volume was estimated from the median annual streamflow volume due to storm runoff computed for the available period of record at Walnut Gulch "prorated by drainage area and applied to the

Babocomari drainage area.”¹⁰ The claimed minimum volume was estimated by assuming a ratio to the median annual streamflow volume identical to the ratio of volumes at the Charleston gage. The claimed minimum volume was apportioned across a twelve month hydrograph of median monthly streamflow assuming a relative monthly distribution identical to that for the Charleston gage. The streamflow claim for the Babocomari River includes the following:

An annual volume up to 2,015 AFA, including a minimum of 800 ac-ft. in median monthly base flows. An additional amount up to the remaining 1,200 ac-ft. of water is to be available in July, August and September as natural “unimpounded and unconstrained random flood events.”

Several technical issues are raised by the Babocomari methodology. The streamflow records for Walnut Gulch consist almost entirely of runoff produced by summer monsoon storms (Stone et al, 2008).¹¹ In contrast, measurements recorded at the USGS station on the Babocomari River, approximately three miles above the confluence with the San Pedro River, shows the majority of flow occurring in the winter months, with only a small peak in August. The natural flow regime of Walnut Gulch is characteristic of most ephemeral washes in southern Arizona. The natural flow regime of the Babocomari River is intermittent flow in its lower reach within SPRNCA and perennial flow in its upper reach.¹² Even if the flow regimes were similar, the differences in drainage area sizes require extrapolations beyond the normally used range.¹³ ADWR recommends an alternative method be used to quantify the streamflow claim for the Babocomari River.

The Department reviewed the information provided by the BLM in the Third Amended SOC and the Streamflow Report. Described below are several tables that the Department constructed to summarize and analyze BLM’s streamflow claim.

¹⁰ This estimation technique, known as the “Drainage-Area Ratio Method,” is generally described in *Estimating Flow-Duration and Low-Flow-Frequency Statistics at Ungaged Stream Sites*, Scientific Investigations Report 2008–5126.

¹¹ Stone, J. J., M. H. Nichols, D. C. Goodrich, and J. Buono (2008), *Long-term runoff database, Walnut Gulch Experimental Watershed, Arizona, United States*, Water Resources:Res., 44, W05S05, doi:10.1029/2006WR005733.

¹² USGS gage No. 09471380 collects data on the upper reach of the Babocomari River outside the boundary of SPRNCA.

¹³ USGS Report 2008–5126 indicates the method is normally used in cases of the drainage-area ratio of the two sites between 0.5 and 1.5. The ratio in this case is 5.3 with the Babocomari drainage area 5.3 times the size that of Walnut Gulch.

Table 3-2 provides a detailed summary of streamflow quantities listed in the Third Amended SOC. These quantities are also described above in more general terms.

Table 3-3 provides comparisons of the seasonal percentage of total annual volumes at the three stations on the San Pedro River measured between 1954 and 1988 with volumes measured during a more recent time period. Also shown in **Table 3-3** is a comparison of the seasonal volumes for the Babocomari River and Walnut Gulch within the SPRNCA. Seasonal percentage of total annual volumes is an indicator of the *timing* component of a given flow regime. The comparisons indicate an overall consistency in the seasonal regularity with which streamflow conditions occurred on the San Pedro River between 1954 and 1988 with a more recent time period. The results also show the Babocomari River and Walnut Gulch have different flow regimes. **Figure 3-8** shows similarities in seasonal percentage for the three San Pedro River Stations. **Figure 3-9** graphically shows the dissimilarities in seasonal percentages between the Babocomari River and Walnut Gulch.

Table 3-4 provides comparisons of the streamflow magnitudes with flood return periods of 1.5, 2 and 5 years at the three San Pedro River stations with magnitudes predicted based on a more recent time period. These return periods were selected because they are within the range of flood events which both shape the geomorphology of the stream channel and affect the distribution and abundance of ecosystems. The flood return periods were predicted using the USGS PKFQWin¹⁴ computer program. Return period is an indicator of the *frequency* component of a given flow regime. The comparisons indicate an overall consistency in the frequency of flooding on the San Pedro River at Palominas and Charleston between 1954 and 1988 with a more recent time period. The analysis indicates a marked decreased frequency of flooding on the San Pedro near Tombstone in the years following the establishment as compared to the twenty years prior.

Table 3-5 provides comparisons of the median annual and monthly volumes at the three stations on the San Pedro River measured between 1954 and 1988 with volumes measured during a more recent time period. Also shown in **Table 3-5** is a comparison of claimed monthly volumes for Babocomari River with volumes measured between 2001 and 2011. Median volumes is an indicator of the *magnitude* component of a given flow regime. The comparisons indicate an overall decreasing trend in the volume of streamflow on the San Pedro River between

¹⁴ The PKFQWin program and documentation is available at: <http://water.usgs.gov/software/>.

1954 and 1988 with a more recent time period. The results also show the claimed volumes of streamflow for the Babocomari River likely exceed volumes that were available in 1988.

Considering a range of factors, the period of record 1954 to 1988 is a reasonable selection for characterizing hydrologic/ecologic conditions present in 1988. It is recommended that an alternative method be used for quantifying the Babocomari claim. Decreasing trends in streamflow of the San Pedro for the summer, spring and fall seasons suggest that current streamflow volumes will more times than not, be less than the volumes listed in the Third Amended SOC.

3.3 THIRD AMENDED CLAIMS FOR MINIMUM GROUNDWATER ELEVATIONS

The BLM Ground Water Report and supporting documentation describe how the elevations of the groundwater claim are intended to conserve and protect ecological functions and processes in a manner similar to their natural state and restore conditions similar to those that existed at the time of the establishment of the SPRNCA.

3.3.1 Snapshot of Groundwater Conditions at Time of Establishment

BLM's claims for minimum groundwater elevations are based on information collected at nine monitoring wells operated by the BLM along the San Pedro River within SPRNCA, and represent a "snapshot" of conditions at the time of establishment (1987-1989). The locations of the BLM monitoring wells are shown in **Figure 2-1**. **Table 3-6** lists the maximum depths to water measured and the corresponding minimum groundwater elevations included in the Third Amended SOC.

Figures 3-10 through 3-18 provide location and 1987-89 depth-to-water hydrographs reported in the Ground Water Report for the BLM monitoring wells. Also shown on these figures are locations of nearby groundwater monitoring wells and hydrographs of water level elevations. The available periods of record for the nearby wells range from a few years between 1987-90 to thirty years near the Cottonwood monitoring well. Overall, the hydrographs suggest relatively stable long-term trends in water levels.

The Department reviewed the methods used by the BLM to collect groundwater level information from its nine monitoring wells. First, it should be noted that groundwater elevations

and depths to groundwater are not interchangeable concepts. The groundwater elevation is unique to a measurement given a known datum. Depths to groundwater can change if based on measurement points instead of depth below ground surface. In Attachment C to the Third Amended SOC and the Ground Water Report, the BLM included water elevation data that was originally collected using an elevation reference point with a given known datum (NAD27), which was then converted to another given known datum (NAVD88) due to changes in the elevation reference point. The BLM also reported depths to water as depths below the elevation reference point, rather than below the land surface. Reporting depths in this manner can lead to confusion or error when the elevation of the reference points periodically changes following maintenance or other activities. The Department recommends that the maximum groundwater depths associated with the claim be referenced to the land surface of each location.

3.3.2 Comparison to Groundwater Levels Measured at Nearby Wells

The Department compared groundwater elevations measured in November or December at each of the BLM monitoring wells circa the time of SPRNCA's establishment with elevations recorded in early December 1990 at GWSI wells along the San Pedro River.¹⁵ **Figure 3-19** shows: the SPRNCA boundaries; locations of shallow GWSI wells along the San Pedro River corridor,¹⁶ and a graph of GWSI December water level elevations plotted throughout the SPRNCA.¹⁷ Using linear regression analysis the graph shows the best-fit trend line, and 50% and 95% confidence intervals.

When plotted onto **Figure 3-19**, nearly all of the BLM 1987-89 groundwater levels and claimed minimum elevations are within the 95% confidence intervals. This suggests that water level elevations measured at the nine BLM monitoring wells, circa the time of SPRNCA's establishment, are correlated to, and generally representative of groundwater elevations along the river within the SPRNCA at that time.

The Department also compared water level elevations recorded in December 2006 from the same GWSI wells examined in 1990. When plotted on **Figure 3-19**, all of the water level

¹⁵ Water levels measured at GWSI wells by the Department in 1990 are a consistent set of measurements taken closest in time to the 1987-1989 BLM measurements. GWSI wells are groundwater site inventory wells that the Department takes measurements from periodically.

¹⁶ Water level data used in the analysis was restricted to relatively shallow wells with depths or perforations no deeper than about two hundred feet to prevent regional aquifer data from confusing the results.

¹⁷ GWSI wells measurements were taken in December and are compared to December measurements at the BLM wells.

elevations collected in December of 2006 are either within the 95% or the 50% confidence interval limits. This information, together with the Department's review of available well hydrographs, indicate a relatively stable long-term trend of water level elevations in close proximity to the San Pedro River channel since the time of SPRNCA's establishment.

3.4 POINT SOURCES

As previously discussed in Chapter 2, the Third Amended SOC cross references Attachment D in the description of the sources of water, the points and means of diversion, and the quantities of use. Attachment D contains a table and individual abstracts that contain information concerning certain discrete or "point" sources within SPRNCA together with four maps that depict their locations.¹⁸ These point sources are located on land that was acquired by the BLM for SPRNCA. For many of these point sources, the prior land owners had filed SOCs based on state law, which are associated with the WFRs that the Special Master consolidated into the contested case for SPRNCA.¹⁹

The three types of point sources listed in Attachment D include: 1) springs and seeps, 2) ponds and small lakes, and 3) wells. They also include "any other naturally occurring waters (e.g., seasonal cienegas, small riverside oxbow lakes, undiscovered seeps, springs, ponds, etc.) within the SPRNCA." The locations for these "other" naturally occurring sources, however, were not specifically identified in Attachment D. BLM claims a total of 94 point sources for a total annual volume of "12,699.647" or 12,700 acre-feet. In April and May, 2012, ADWR conducted a field inspection of several of the point sources included in the Third Amended SOC.

Table 3-7 presents a summary of the point sources described in the Third Amended SOC and the Department's review of its database records related to those point sources. In addition, **Table 3-7** includes information concerning filings which pre-dated BLM's acquisition of the property on which the point sources are located, observations from ADWR's field visits to selected sites, as well as the WFRs that are associated with each point source.

¹⁸ In this section, the term "sources" is used to reference the 94 features listed in Attachment D called "point sources." Not all of the features listed in Attachment D meet the standard definition of a water source. Naturally occurring springs, seeps and ponds are normally considered sources of water. Wells are normally considered as points or means of diversion. Constructed impoundments store water obtained from a water source for future use.

¹⁹ See Order of the Special Master dated September 26, 2006, Attachment A.

The springs and seeps, ponds and small lakes, and wells listed in Attachment D are described in the following sections and depicted on **Figure 3-20**. Also described are any discrepancies between BLM's information and the Department's database information, and the results of the Department's field inspection.

3.4.1 Springs and Seeps

A total of 29 springs and seeps are claimed as point sources for SPRNCA, which are listed in **Table 3-7** as sites 48 through 76. Springs and seeps are generally located in close proximity to the San Pedro River and are claimed to be a direct source of water for the purposes of supporting wildlife, aquatic habitat and recreational uses within the conservation area. The amount of water claimed for springs and seeps is the measured flow in gallons per minute ("GPM") with a corresponding volume per annum in acre-feet ("AFA"). The total combined claim associated with springs and seeps, as listed in Attachment D, is 1,315.587 AFA.

BLM reported the flow rates observed during 2003 and 2004 for each of the springs and seeps listed in its claim.²⁰ These reported discharge rates are the basis for the claimed quantities of use listed in Attachment D. The reported flow rates cannot be reviewed and verified because Attachment D does not include complete measurement records. Dimensions of saturated areas were only provided for 14 of 29 listed features.

BLM's point source abstracts indicate that 10 claimed springs and seeps have associated state-based water rights, including 8 certificates of water right. **Table 3-7** lists the associated state-based rights, where applicable, for each of the claimed springs and seeps. Flow rates reportedly observed during 2003 and 2004 in some cases appear to be inconsistent with quantities described in state-based rights.

The Department performed a series of field inspections of springs and seeps located in SPRNCA, at sites 48, 50, and 70, and confirmed that their locations and associated uses appear to be consistent with the federal claim. The springs field inspected by the Department are noted in **Table 3-7**. Due to time constraints and weather, the Department's inspection was limited to 3 of the 29 claimed spring and seep locations. The Department confirmed seepage discharge

²⁰ This information was included in a spreadsheet that accompanied the abstracts for each point source that were included on the CD-ROM.

conditions for the each of the visited spring and seep sites, but did not perform instantaneous measurements of flow rates.

The BLM did not provide seepage discharge rates at the springs and seeps at or prior to the time of SPRNCA's establishment. The BLM did not provide a rationale for quantifying the flow rates from springs and seeps based on a snapshot in 2003-2004 rather than 1988, which was the time of SPRNCA's establishment that was used for BLM's minimum streamflow and groundwater elevations claims. BLM also did not provide any information concerning changes in the seepage rates over time, dating from SPRNCA's establishment. The snapshot of 2003-2004 flow rates are not supported by investigations of hydrogeology and sources of water at the seeps and springs. The Department believes that some un-estimated portions of the seepage discharges contribute to streamflow, but the relationships between the seepage discharge rates claimed for springs and seeps, the minimum streamflow volumes, and the minimum ground water elevations are not known.

3.4.2 Ponds and Small Lakes

A total of 18 ponds and small lakes are claimed as point sources for SPRNCA, which are listed in **Table 3-7** as sites 77 through 94. The ponds and small lakes are claimed to be direct sources of water for the purposes of supporting wildlife and recreational uses within the conservation area. BLM states that the amount of water claimed for ponds and small lakes in Attachment D is based on measurements taken during 2004. The maximum capacity of each pond is multiplied by one or two fills annually, depending on location. Each of the 18 ponds has an annual volume listed in Attachment D, and they account for a combined total storage volume of 53.44 AFA.

Through the use of aerial photography, the Department reviewed and verified that all claimed impoundments were near their claimed location. However, the documentation provided to the Department by BLM was insufficient to allow the Department to make an evaluation of storage capacities. In order to compute and verify the storage capacities for each of the claimed impoundments, the Department needed the corresponding embankment heights and/or pond depths, which could only be obtained through field verification.

The Department was able to verify the location and condition of 13 of the 18 claimed impoundments through fieldwork, as indicated in **Table 3-7**. Several of the claimed ponds and

small lakes (occurring south of the San Pedro House and along the San Pedro Trail) at sites 83 through 88 appear to be old remnant excavated pit structures associated with past sand and gravel quarry operations. These claimed impoundments are located near, or adjacent to, the San Pedro River and do not have berms or dams to act as traditional impounding or diverting structures. The pits themselves now appear to be unmaintained and left to blend with the surrounding natural environment. It is likely that they are periodically inundated following heavy precipitation or river flooding events due to their relative location to the San Pedro River. As they appeared during the Department's inspection, the water levels in a few of these ponds at sites 83, 86, and 88 were equal to or slightly less than the river stage.

At another location near Palominas, several of the claimed impoundments at sites 78 through 81 appeared to be a series of check dams emplaced in a small drainage channel. These claimed tanks most likely appear to have been constructed for the protection of historic irrigated fields. They currently appear unmaintained and left to blend with the natural landscape. Two of the tanks at sites 78 and 79 were observed to be breached and unable to store water. The other two at sites 80 and 81 were found to be partially breached.

For each of the field inspected ponds, the Department took measurements of the surface area at an estimated spill level (the hydraulic height control point), and estimated berm heights and pond depths where possible. The estimated field measurements allowed the Department to calculate a current volume capacity for each impoundment which was then compared to the claimed volumes presented in the Attachment D.²¹ The Department's calculations are presented in **Table 3-7**. For the 13 tanks the Department was able to measure, the combined maximum storage capacity was estimated to be approximately 61.5 acre-feet. This amount compares to approximately 49.5 acre-feet based on the claimed amount in Attachment D.

3.4.3 Wells

A total of 47 wells, including 28 large production and 19 small capacity wells, are claimed as point sources for SPRNCA, which are listed in **Table 3-7** as sites 1 through 47. Claimed well locations were verified both by the use of aerial photography and by cross-

²¹ The formula used by the Department to estimate storage capacities is $0.4 \times \text{hydraulic height (ft)} \times \text{surface area (acres)}$, where 0.4 represents a shape coefficient.

referencing the Department's database records. All wells were verified to be at or near their claimed locations.

The 28 large production wells were identified in Attachment D as being part of a combined groundwater claim for 11,150 AFA. The remaining 19 small capacity wells each have a corresponding annual volume listed in Attachment D, and account for a combined total of 180.62 AFA. The total annual volume claimed for all 47 wells is approximately 11,330.62 acre-feet.

The Department visited ten claimed wells at sites 1, 3, 4, 5, 18, 20, 22, 26, 34, 43 for field inspection to determine their location and condition. At several of the visited sites, the wells appeared to have been abandoned and/or destroyed. Most had no operational pumps or current electric power supply, and one was capped. The wells that the Department field inspected are noted in **Table 3-7**.

3.4.4 Point Source Claims Associated With State-Based Rights and Contested Case WFRs

Table 3-7 provides results from cross-referencing the point source claims to applicable state-based filings on record with the Department. The point sources are additionally cross-referenced to the contested case WFRs listed in Attachment A to the Special Master's September 26, 2006 Order, which consolidated those WFRs into the SPRNCA contested case. This order is included in **Appendix A**.

Of the 94 point source claims included in Attachment D, 64 were found to be associated with state-based filings. Department records indicate that all of the applicable state filings, with respect to each point source, have been assigned to the BLM, the current right holder of record, with the exception of site nos. 20, 22, 48, 78 through 80, and 91. Also, 63 point sources are associated with the contested case WFRs that the Special Master consolidated into the SPRNCA contested case.

3.4.5 Point Source Locations

Attachment D to the Third Amended SOC lists the locations for claimed point sources in SPRNCA using BLM's GPS coordinates, in NAD27 datum, as presented in BLM's Second Amended SOC in 2006. In October 2011, BLM provided the Department with its updated landownership information including GIS covers and revised tables for the point sources. The

Department used BLM's updated information to determine whether the claimed point sources are included on federal land within SPRNCA.

The Department determined that there were two instances where the point sources appeared to be located on private land within SPRNCA and also one instance where the point source appeared to be located outside of the SPRNCA boundary. These are summarized below.

- (1) Site # 74 (Unnamed Spring near Contention): The claimed location is based on NAD 27 Lat. Long. 31 50 18.56 110 13 25.8 GPS coordinates . This places the spring on privately held land, assessors' parcel no. 108-01-006, a right of way, but we were unable to confirm due to weather.
- (2) Site #43(Donlevy-Shields Well): The claimed location is based on NAD 27 Lat. Long. 31 50 33.74 110 12 45.5 GPS coordinates. This places the well on privately held land, assessor's parcel no. 121-01-003B.
- (3) Site # 34 (Anderson Well): The claimed location is based on NAD 27 Lat. Long. 31 36 06.50 110 09 06.7 GPS coordinates. This places the well within assessor's parcel no. 107-28-004B, in the Escapule Exclusion Zone, outside of SPRNCA.

These discrepancies could be the result of GPS coordinate errors. The Department recommends that the three sites be further evaluated to determine whether they should be included in the Third Amended SOC.

3.5 SUPPORTING DOCUMENTATION FOR DEPENDENCE OF RIPARIAN COMMUNITIES ON STREAMFLOW AND GROUNDWATER LEVELS (Riparian Report)

The Third Amended SOC claims minimum streamflow volumes and minimum groundwater elevations for uses that include maintenance of natural hydrologic processes supporting riparian ecosystems; and the conservation, protection and enhancement of riparian environmental values. In its Riparian Report, BLM uses the findings and results from a

coordinated study²² published in 2005 by the USGS²³ to characterize riparian ecosystems (c. 2001-2003) and their dependence on the surface water and groundwater of the area (“USGS Study”). Dependent relationships from the USGS Study are used to infer likely conditions at the time of SPRNCA’s establishment in 1988.

3.5.1 Data Collection Sites and Classification Reaches from the Riparian Report

As part of the USGS Study, information of vegetation structure, composition, and species diversity was collected at twenty-six sites within SPRNCA. Biohydrology sites were established at sixteen of these locations where detailed measurements of streamflow and groundwater conditions were collected. Information of total evapotranspiration rates was collected at five of the biohydrology sites. For classifying different hydrologic conditions and the vegetation they support, fourteen reaches based on conditions of hydrology and geomorphology were delineated, covering the full extent of SPRNCA. The USGS Study estimated a total groundwater use by riparian vegetation within SPRNCA of 10,630 to 12,775 ac-ft. in the year 2003. The Department did not independently evaluate the consumptive use requirements of riparian vegetation within SPRNCA.

3.5.2 Riparian Ecological Conditions in SPRNCA c. 2001-2003

The USGS Study used information collected between 2001 and 2003 on vegetation and hydrology to define three prevalent “condition classes” at stream reaches within SPRNCA. Hydrologic factors found to be the most closely correlated with differences in riparian communities were the prevalence of streamflow in the river channel, maximum depth to groundwater, and annual fluctuations in groundwater depths.

Table 3-8 summarizes the condition classes defined as part of the USGS Study. **Figure 3-21** is from the USGS Study and shows riparian ecological conditions c. 2001-2003 for the full extent of SPRNCA.

²² Study participants included the USGS, USDA-ARS, Arizona State University, U.S. Army Corps of Engineers, the University of Arizona and the University of Wyoming.

²³ Leenhouts, J. M., Stromberg, J.C., and Scott, R.L., eds., 2006, *Hydrologic Requirements of and Consumptive Ground-water use by Riparian Vegetation along the San Pedro River, Arizona*: U.S. Geological Survey Scientific Investigations Report 2005–5163, 154 p.

3.5.3 Inferred Riparian Ecological Conditions in SPRNCA at Time of Establishment

In its Riparian Report, BLM used the USGS Study condition classes to infer likely riparian ecological conditions within SPRNCA at the time of establishment in 1988. Using the claimed volumes of streamflow and annual flow duration curves, BLM concluded that conditions in 1988 at Charleston provide perennial flow, which placed that location in Condition Class 3. BLM also concluded that its claims at the Palominas and Tombstone gages placed those locations in Condition Class 2 because the claimed streamflows provided flow over 85% of the time. Using the claimed minimum groundwater levels, BLM concluded that the 1988 depths to groundwater likely would have supported Condition Class 3 for at least a small portion, and Condition Class 2, for a significant portion of the cross sections at the nine monitoring wells included in BLM's groundwater claim.

The Department reviewed the information in the Riparian Report and understands the approach taken to infer riparian conditions at the time that SPRNCA was established in 1988 based on data collected from 2001 to 2003. However, BLM's data presented in the Riparian Report is incomplete. The flow duration curve for the Charleston gage and the cross sections for three of the well sites were not included in the report. The Department recommends that BLM be required to supply the missing information.

3.6 SUPPORTING DOCUMENTATION FOR DEPENDENCE OF AQUATIC HABITAT ON STREAMFLOW (Aquatic Habitat Report)

The Third Amended SOC claims minimum streamflow volumes for uses that include maintenance of natural hydrologic processes supporting aquatic ecosystems; and the conservation, protection and enhancement of aquatic environmental values. The BLM commissioned the preparation of the Aquatic Habitat Report, which characterizes changes in habitat availability for fish as a function of changes in streamflow. The purpose of the Aquatic Habitat Report is to provide a framework for assessing changes in physical habitat in the river as a function of flow for four fish species of interest, and a tool to assess streamflow needed to preserve and enhance the aquatic species in SPRNCA. Habitat time-series developed as part of the study are used to infer likely conditions at the time of establishment in 1988 and compare conditions of more recent time.

3.6.1 Selection of Reaches, Channel Types and Data Collection Sites

The area covered by the Aquatic Habitat Report includes the entire lengths of the San Pedro and Babocomari Rivers within SPRNCA. The San Pedro River is divided into three reaches of differing stream channel types based on hydrology, geomorphology and habitat characteristics. The Babocomari is studied as a single reach, for a total of four reaches in the study. Within each of these four reaches, a quarter-mile length of river was selected as a hydraulic study site for detailed field measurements of streamflow conditions and two-dimensional hydraulic computer modeling.

Figure 3-22 is from the Aquatic Habitat Report and shows the extent of each of the four channel type reaches with markers added to show locations of the hydraulic study sites. **Table 3-9** lists the names of the hydraulic study sites and reaches, basic channel characteristics common to each reach, lengths of the reaches in miles, and the source(s) of streamflow data used within each reach for hydraulic modeling analyses.

3.6.2 Development of Habitat Area versus Discharge Relationships at Selected Sites

For each of the four hydraulic modeling sites, a set of habitat area versus discharge relationships were developed for four native fish species. Habitat area is not a direct function of discharge, but instead is a function of the localized flow depth and velocity as well as substrate, cover and other channel conditions. For each species, these relationships were developed based on 2001 hydrology, water quality and fishery data and referred to as habitat suitability data. Two of the fish species, the desert sucker and longfin dace, are currently present in the SPRNCA, allowing habitat suitability data to be field collected as part of the study. The other two species, spikedace and loach minnow, were historically abundant in the San Pedro River watershed but currently are limited to Aravaipa Creek. Although SPRNCA is designated as critical habitat for

the spinedace and the loach minnow,²⁴ the habitat suitability data were taken from existing studies at Aravaipa Creek.

When suitability data is coupled with two-dimensional hydraulic flow modeling using geographic information systems (GIS), a habitat area versus discharge relationship is obtained. Due to the steps required for the process, the validity of these relationships is limited to the hydraulic modeling site for which they are developed and other nearby sites with similar enough channel characteristics to have very similar distributions of flow depths and velocity in response to a given streamflow discharge rate.

3.6.3 Development of Monthly Habitat Time-Series

A habitat time-series describes how the area of available habitat for a given species changes over time with changes in streamflow. It is developed by coupling a habitat-discharge relationship with a selected streamflow hydrograph and integrating (summing) the total area of available habitat along the entire reach for which the habitat-discharge relationship is applicable. Because the habitat-discharge can be coupled with different streamflow hydrographs to obtain different results, this can be a useful tool to either infer the amount of area available during past conditions or project conditions into the future.

Habitat time-series were developed using median monthly hydrographs and average daily hydrographs at each of the three USGS gage sites used for quantifying the streamflow claim on the San Pedro River and for the estimated streamflow on the Babocomari River. Habitat time-series were developed using streamflow values recorded prior to establishment of SPRNCA and compared with measurements recorded after establishment. The Aquatic Habitat Study concluded that “the proposed hydrology would benefit the aquatic community and provide habitat that is more abundant and more permanent than the habitat that currently exists with the San Pedro River. This permanence also would benefit the supporting macroinvertebrate community which has several species that are in decline and that are rare for Arizona watersheds.” Aquatic Habitat Study (p. 118).

For studies of this type, the accuracy of the habitat area calculations in the monthly time-series analysis is limited by several factors and probably best understood in terms of the orders of

²⁴ Critical habitat is a term used in the Endangered Species Act of 1973 (16 U.S.C. § 1531 *et seq.* It generally includes geographic areas that contain features essential for the conservation of a threatened or endangered species that may require special management considerations or protections.

magnitude of the results.²⁵ The reported findings are indicative of reasonable, expected trends. The Aquatic Habitat Report uses a state-of-the-practice incremental approach to assess the effects of differing flow regimes on aquatic habitat and populations. The developed models appear to provide a reasonable approach by which to describe conditions of aquatic habitat and assess likely changes. They also may provide a mechanism by which to either infer past or predict future conditions within SPRNCA using streamflow data.

²⁵ For example, the presence of non-native fish is a limiting factor. Aquatic Habitat Report (p. 23). Also, it is not clear that the data collected for the longfin dace in the San Pedro River compares favorably with the data collected in Aravaipa Creek. *Id.* at pp. 56 to 57.

CHAPTER 4:
STATE LAW WATER
RIGHTS

CHAPTER 4: STATE LAW WATER RIGHTS

This chapter describes BLM's state-law based water rights related to instream flows within SPRNCA. BLM holds certificate of water right ("CWR") No. 33-90103 for instream flows on the San Pedro River, and two pending applications for permits to appropriate instream flows, one on the San Pedro River (Application No. 33-95780) and the other on the Babocomari River (Application No. 33-94587).

The following sections describe BLM's existing CWR and its two pending instream flow applications. The reaches covered by the CWR and the two pending applications are depicted on **Figure 4-1**. Copies of the CWR and the pending applications are included in **Appendix D**.

4.1 CERTIFICATE OF WATER RIGHT NO. 33-90103

On August 12, 1985, the Huachuca Audubon Society, Chiricahua Sierra Club and Defenders of Wildlife filed a joint application for a permit to appropriate instream flows on the San Pedro River for recreation and wildlife purposes, including fish, and later assigned the application to the BLM on May 25, 1986. The BLM amended the application twice, first on December 4, 1987 and then on December 7, 1990.¹ On April 3, 1992, the Department issued CWR No. 33-90103 to BLM with a priority date of August 12, 1985, for certain monthly instream flows totaling 3,666 AFA at the Palominas gage (USGS gage no. 09470500) and 11,028 AFA at the Charleston gage (USGS gage no. 09471000).

The monthly volumes stated in CWR No. 33-90103 at the Palominas and Charleston gage stations are computed using average monthly median flows for the period of record from 1930 to 1983, as provided by the BLM. In support of its amended application, BLM provided a discussion of flows of the San Pedro River at the Palominas and Charleston gages in a technical report entitled, *Assessment of Water Conditions and Management Opportunities in Support of Riparian Values*, BLM San Pedro River Properties, Arizona, Project Completion Report, U.S. Dept. of the Interior, Bureau of Land Management, Arizona State Office, 1987. The volumes are

¹ On March 3, 1989, BLM filed SOC No. 39-13611 and listed Application No. 33-90103 as the legal basis for the claim. The place of use for this SOC was amended on February 1, 1991, with the same monthly flows as those listed on CWR No. 33-90103.

reportedly derived by averaging the median monthly streamflow between 1930 through 1983 and then applying certain corrections. Omitting the extreme highs that occurred due to flooding in 1979 reduces the computed average median streamflow for January. Computed streamflow during the summer months are reduced because higher measured summer flows were influenced by storm runoff during July, August and September.

Table 4-1 lists the monthly volumes at the Palominas and Charleston gage stations stated in CWR No. 33-90103 and compares them to the streamflow quantities claimed in the Third Amended SOC. At the Palominas station, the total of the monthly streamflow volumes in the CWR is twenty-six percent larger than the BLM claim. At the Charleston station, the total of the monthly streamflow volumes in the CWR is one percent smaller than the BLM claim. The CWR does not include any provision for “unimpounded and unconstrained random flood events” as considered by the Third Amended SOC.

4.2 PENDING APPLICATION NOS. 33-95780, 33-95487 AND 33-95789

Application No. 33-95780

On January 8, 1991, BLM filed Application No. 33-95780 for a permit to appropriate instream flow along the upper reach of the San Pedro River in the amount of 3,674 AFA for recreation and wildlife purposes. The upper reach includes the San Pedro River within the boundaries of SPRNCA from the international border with Mexico to the bridge crossing in Palominas, which totals approximately three miles in length.

By letter dated May 31, 1991, BLM submitted a report entitled *Analysis of Water Resources And Water-Dependent Resources In Support Of Instream Flow Water Rights, San Pedro River, Arizona (#33-95780)*. This analysis was later revised by cover dated March 2, 1993 (“Amended Analysis”). The Amended Analysis indicated that BLM considered the upper reach of the San Pedro River to be similar in character hydrogeologically and physically to the downstream reach under instream flow CWR No. 33-90103, and that the justification and water requirements for each beneficial use were based on the assessment submitted with Application No. 33-90103. As shown in **Table 4-1**, the monthly volumes are identical to those stated in CWR No. 33-90103 at the Palominas gage station.

A protest was filed to the application dated January 30, 1991. The Department has not taken any further action on Application No. 33-95780.

Application No. 33-95487

On October 2, 1990, BLM filed Application No. 33-95487 for a permit to appropriate instream flows along the Babocomari River within the boundaries of SPRNCA, which totals about 3 miles in length.² The annual quantity sought to be appropriated is 3,243 AFA for wildlife (including fish) and recreation purposes.

On January 8, 1991, BLM submitted a report entitled, *Analysis Of Water Resources And Water-Dependent Resources In Support Of Instream Flow Water Rights, Babocomari River, Arizona (#33-95487)*. In this report, BLM indicated that surface flows had been measured at ten sites during March and June of 1988, and that they were measured weekly at the confluence by BLM. According to the report, BLM then corrected these values to account for drought conditions. The streamflow measurements were not included with the report or the application.

By letter dated January 11, 1994, the Department informed BLM that Application No. 33-95487 was incomplete due to lack of streamflow data and documentation that supported the quantity of water requested for the stated beneficial uses. The Department also requested additional information by letter dated June 30, 1998. In the year 2000, the USGS installed a continuous water-stage recorder, gage no. 09471400, within the claimed reach.

A protest was filed to the application dated January 2, 1991, which was withdrawn by letter dated February 11, 1991. The Department has not taken any further action on this application.

Table 4-1 lists the monthly volumes stated in Application No. 33-95487 and compares them to the streamflow quantities claimed in the Third Amended SOC for the Babocomari River within the SPRNCA. The total of the monthly streamflow volumes in the CWR is three-hundred percent larger (three times as large) than the BLM Claim. As discussed in Chapter 3, the Department recommends an alternative approach be used for quantifying the claim to the

² On September 12, 1989, BLM filed an amendment to SOC No. 39-007752, which had originally been filed by the State Land Department. The basis of the claim was listed as Water Rights Registry (WRR) Claim No. 36-04720 and federal reserved water rights. In its September 12, 1989 amendment, BLM also listed WRR Claim No. 36-04720 as the basis of the claim. On October 12, 1990, BLM amended SOC No. 39-07752 again and listed Application No. 33-95487 as the basis of the claim with the same monthly flows as in the application.

Babocomari River. The annual volume, as stated in Application No. 33-95487, is roughly ten times as large as the median monthly volumes measured at the USGS gage since 2000.

Application No. 33-95789

On April 1, 1991, BLM filed Application No. 33-95789 for a permit to appropriate instream flows along two stretches of the San Pedro River within the boundaries of SPRNCA, which totals about 43.8 miles in length. The annual quantity sought to be appropriated is an “instantaneous peak flow of 18,200 cubic feet per second and a 24-hour volume of 11,300 acre-feet the first time it occurs during the year” for wildlife, including fish and recreation purposes. This volume was calculated as the 10-year return period flood event based on streamflow data at the Charleston gage station, and estimated to be the flood amount necessary to fully inundate the floodplain adjacent to the river channel.

Two protests, dated April 1, 1991 and August 27, 1991, were filed to the application.

By letter dated March 18, 1994, the Department requested a plan of action regarding BLM’s ability to meet the minimum requirements of an instream flow permit as required by the Department and discussed in the instream flow guideline publication. The Department has not taken any further action on this application.

**CHAPTER 5:
SPRNCA LAND
OWNERSHIP UPDATE**

CHAPTER 5: SPRNCA LAND OWNERSHIP UPDATE

5.1 INTRODUCTION

As requested by the Special Master's Order dated August 16, 2011, this chapter reviews the land ownership information for SPRNCA that BLM presented in its Third Amended SOC. In Attachment A to the Third Amended SOC, BLM presents a series of seven maps and an index map that depict SPRNCA's boundary and the ownership status of the lands contained within that boundary. These maps include the following lands: (1) BLM pre-designation lands, (2) BLM post-designation acquisitions, (3) state land, (4) private land, (5) military land, and (6) national forest land. In Attachment E to its claim, BLM presents a large map of SPRNCA, which depicts the same lands as those presented in the maps in Attachment A, together with a table that lists the dates of acquisition of post-designation lands.

The SPRNCA map was submitted to Congress pursuant to P.L. 100-696 in July 2010, which was after the Department issued its report to the Special Master concerning land ownership within SPRNCA. As requested by the Special Master, on June 30, 2010 the Department filed a report entitled "Land Ownership Within the San Pedro Riparian National Conservation Area" in which the Department identified several issues which had been discussed with BLM concerning its earlier map of SPRNCA and the land ownership status of the lands within SPRNCA's boundaries. BLM revised its earlier map for submittal to Congress and addressed many of the issues identified by the Department. At the Department's request, BLM provided the Department with GIS data (shape files) for its revised 2010 map in October 2011. A copy of this data is included in **Appendix E**.

On April 15, 2011, at the request of the Special Master, the Department supplemented its land ownership report by providing additional information concerning BLM's acquisition of 26 parcels of land after November 18, 1988, the date that SPRNCA was designated. On the table with the revised SPRNCA map, The Third Amended SOC lists 19 post-designation land transactions with assigned serial numbers, together with their dates of acquisition and acreage within SPRNCA.

In this chapter, the Department describes its review of the revised SPRNCA boundary and land ownership map submitted with the Third Amended SOC. The Department also

describes its review of the post-acquisition parcels listed in Attachment E to BLM's claim to determine whether the dates of acquisition and acreages are consistent with the Department's information.

5.2 SPRNCA BOUNDARY UPDATE

The Department compared the GIS data that BLM forwarded to the Department in October 2011 with the Department's June 2010 report and found a few minor discrepancies, which are depicted on four maps. These maps are included in **Appendix F**, and depict boundary issues located in SPRNCA's northeast corner (Map 1), the Escapule Exclusion Zone area (Map 2), the southern tip of the main reservation (Map 3), and the southern part of SPRNCA (Map 4). Some of the observed differences may be a reflection of the latest data BLM incorporated into its SPRNCA GIS covers.

The Department compared the acreages reported in the Department's June 2010 land ownership report with the October 2011 data supplied by BLM. Based on its 2011 GIS data, the BLM claimed 56,249.39 acres of federal lands within SPRNCA, which is 77.19 acres more than the 56,172.2 acres of federal land identified by the Department in its 2010 land ownership report. These numbers include both pre- and post-designated lands. The BLM's claimed acreage is 0.14% higher than the Department's acreage. The Department believes that the difference is due to the digitization of parcels intersected by the SPRNCA boundary to determine the portion of the acreage within SPRNCA.

5.2 POST-DESIGNATED ACQUISITIONS UPDATE

The BLM listed 19 post-designated land acquisitions, which include the 26 parcels listed in the Department's 2010 land ownership report. The BLM listed its 19 land acquisitions with 14 Map Codes and corresponding serial numbers. Map Code 10 included six serial numbers. Five of the serial numbers, consisting of AZA 0396801 through 0396805, are not listed separately in BLM's 2011 GIS data, but are most likely subsets of AZA03968, which is the sixth serial number included in Map Code 10 and found in BLM's GIS data set. Because the

Department could not relate the information for these five individual parcels back to the Department's information, which relied upon the relationship between the serial number and the assessor's parcel number, the Department totaled the values for all parcels with the 03968 prefix together for comparison purposes,. For the remaining parcels, the Department confirmed that BLM's acreages were the same as those reported by the Department in 2010, with the exception of two parcels in Map Code 6 that are adjacent to a railroad right-of-way. Based on the information in Appendix F to the Department's 2010 land ownership report, the Department determined the following:

(1) Parcel No. 107-24-005, consisting of 23.412 acres, was listed by BLM in its 2011 data set of post-designated lands, however, this parcel was actually acquired prior to designation.¹ As a result, it appears that the total number of post-designation acres included in the table on the revised SPRNCA map in the amount of 2,083.596 acres should be reduced by 23.412 acres to 2,060.184 acres.

(2) The digitized acres included by BLM in Parcel No. 107-24-016 were 385.114 acres, which is 16.686 acres less than the 401.800 acres identified by the Department. This parcel was intersected by the SPRNCA boundary, and the Department believes that these differences are due to the digitizing process for determining how many of the acres in this parcel were located within SPRNCA.

The Department also compared the total acreage claimed in BLM's 19 land acquisitions with the total acreage included in the Department's 2010 land ownership report and confirmed a difference of approximately 28 acres. The post-designation acres claimed by BLM total 2,083.596 acres. When this number is reduced by 23.412 acres to 2,060.184 acres, as described above, it is 28.326 acres less than the Department's reported acreage of 2,088.451 acres. As mentioned above, the Department believes that this discrepancy is primarily the result of the digitization processes used by the BLM and the Department.

The Department also compared the dates of acquisition listed by the BLM on its revised SPRNCA map with those included in the Department's 2011 supplemental land ownership report. There are several differences which are presented in **Table 5-1**. As indicated in the

¹ The Department's 2010 report indicates that the number of acres included in the deed dated October 1988 for parcel no. 107-24-005 was 87.015 acres.

Department's 2011 supplemental land ownership report, the Department is not aware of any documentation that establishes which of the various dates reported from the BLM Serial Register pages resulted in the formal incorporation of these lands into SPRNCA.

Finally, the Department believes that there are three typographical errors in the BLM GIS data set for the SPRNCA lands. These errors include the following:

- (1) Serial number AZA 02085 should be AZA 028085,
- (2) Serial number AZA 028019 should be AZA 029019, and
- (3) Serial number AZA 028189 should be AZA 029189.

BLM used the correct serial numbers in the table on the revised SPRNCA map.

The Department believes that the differences described above are relatively minor, and that the SPRNCA boundary and land ownership information provided by the BLM is reasonably accurate. The Department appreciates that the parcel boundaries cannot be established with precision due to the limitations of the digitization process.